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Hill 519th SMXS SEON team helps track recent solar flares

By Bill Orndorff
309th Maintenance Wing
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Technology produced by the 309th Software Maintenance Group and installed at weather observatories throughout the world help detect the intense solar flares such as those experienced in late January and early February.

The flares, which resulted in the aurora borealis being visible in much of the Northern Hemisphere, are detected by solar radio antennas and solar optical telescopes. The software for these telescopes is developed, updated and maintained by the 519th Software Maintenance Squadron Solar Electro-Optical Network -- SEON -- team.

"The telescopes and antennas have the tools analysts use to detect solar flares, bursts and sweeps," said Todd Rhodes, supervisory electronics engineer in the 519th SMXS. "There are five observatories throughout the world that track solar events for the Air Force Weather Agency. The radio sites have antennas to receive the information, frequency and intensity from the sun, and the optical sites have a visual telescope. We help with both."

Sites with both optical and radio capabilities are located at Learmonth, on Australia's west coast; and San Vito dei Normanni, on Italy's southeast coast. Radio sites are at Ka'ena Point, on the northwest side of Oahu, Hawaii; and Sagamore Hill near Hamilton, Mass. An optical site is also at Holloman AFB, N.M.

"At any period of time, one or two sites are receiving the sunlight," Rhodes said. "During the long days of summer, there can be three sites observing the sun at one time."

The software sustained by the SEON team directly impacts astronaut safety and satellite sustainability through forecasting solar phenomena that cause electromagnetic radiation. Those forecasts provide alerts, warnings and assessments for operational impacts to the Air Force and other DoD agencies. Software developed by the SEON team receives and interprets data from the instruments and provides approximately 10 forecast summaries an hour to Air Force solar forecasters.

The SEON team's programs generate more than 87,000 reports annually, which accounts for 7 percent of all the National Oceanic and Atmospheric Administration Space Weather Prediction Center products. The SEON software team incorporates complicated algorithms -- mathematical procedures for calculating a function -- from physicists and scientists into software code to keep forecasting accurate. The team improves the physical brains of the system, and the updated products control the measuring equipment that digitizes signals.

"Most of the algorithms were established, but the old computers could only approximate them," Rhodes said. "The new computers are powerful enough to do the actual algorithms. Our team encoded it into the program and the results are closer to reality than the approximations."

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The 16-member team is currently undertaking projects that will greatly improve the SEON software. In 2010, they incorporated solutions for 13 deficiency reports that improved effectiveness and accuracy of forecasts. They also submitted 60 document changes to software and hardware requirements to ensure the equipment is up-to-date and the best available.

The team is now placing all the SEON sites onto a network to create a central data hub at the Air Force Weather Agency. Having centralized access to information will improve the process and management for solar phenomena forecasting.

"To send the images and data, we've had to mail them on a DVD," Rhodes said. "Now we're going to where the data is deposited through the NIPRNET (non-classified internet protocol) server at the Air Force Weather Agency. The solar radio spectrograph has been completed; they're using it at Sagamore Hill but it hasn't been installed at the other sites. On the optical side, the Solar Optical Observing Network -- SOON -- control system has gone through development testing and will be installed later this spring."

At Hill AFB, the SEON is maintained in a lab, located in a secure area of Building 1515, that is set up to view solar activity and simulates what an analyst sees at the five sites. The set up has two main computers -- one with three screens to analyze optical data, the other with four to analyze radio signals. In the background, a world map shows the radio and optical sites and where the sunlight reaches at any hour of the day.

The team is also working on a major improvement to the optical observatories.

"The old system used a rough grid of the sun to identify the spots," Rhodes said. "The new images come from the telescopes at the five sites, and are loaded into the computer as a jpg file. The Improved Solar Optical Observing Network, or ISOON, is a joint effort with the Air Force Research Laboratory."

Sequences and images received from the five observatories are used to detect solar flares as they grow.

"They can bring up the images and use it as a snapshot in time to see how the brightness changes," Rhodes said. "Flares can affect the earth as soon as 15 minutes or it could take two or three days. As a flare is detected, the team has two minutes to respond to the Air Force Weather Agency."

The work by the SEON team was nominated for the 2011 Rotary National Award for Space Achievement Foundation's Stellar Award. The awards recognize team achievements in government, military and industry and are based on accomplishments that hold the greatest promise for furthering future activities in space.

Team members nominated from the 309th SMXG were Todd Rhodes, Kevin Bartholomew, Eric Cannon, Kyle Cannon, Scott Haymore, Ron Hubbard, Tim Julian, Robert McKinlay, Clive Rudd, Nathan Sachs, Dennis Vuong, Steve Weir and Jake Zohner.

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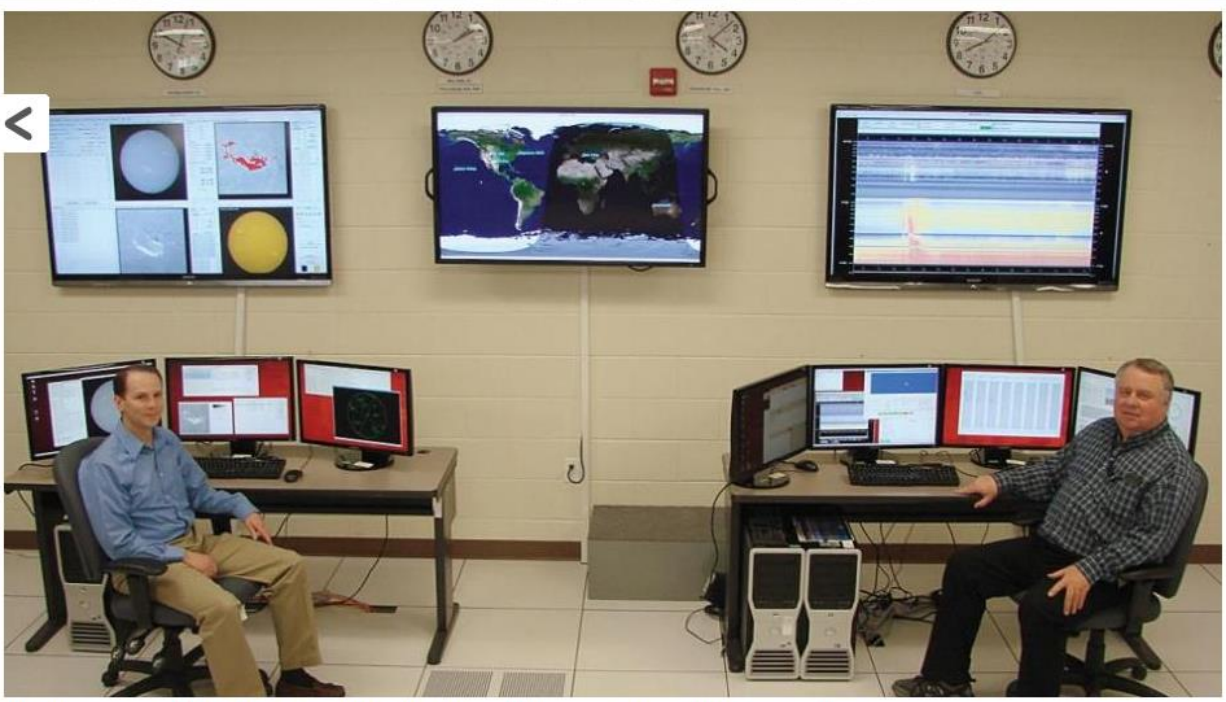

Solar flares are tracked at Hill Air Force Base by the 519th Software Maintenance Squadron Solar Electro-Optical Network team. Nathan Sachs (left), and Clive Rudd display samples of solar activity observed on the network lab computers in Building 1515. Wall clocks show the time in the tracking sites around the world.
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